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Late summer/early autumn records of fresh *Pontia chloridice* from Greece (Lepidoptera: Pieridae). Evidence of a third emergence per year

Hristos T. Anastassiu, John G. Coutsis & Nikos Ghavalas

Abstract. The occurrence of fresh specimens of *Pontia chloridice* (Hübner, 1813) flying in late August/early September is reported here for the first time for Greece. The butterfly was found to be common in two different localities, one situated in the central Rodhópi Mts., the other in the eastern part of the mountain range, and both in the vicinity of the Greek-Bulgarian border. The fresh condition of the majority of specimens implied that they could not possibly be remnants of the 2nd generation that normally flies from June to mid-July. This conjecture is supported by the fact that the HW underside greenish markings are often darker than in the summer brood individuals.

Samenvatting. Het voorkomen van verse exemplaren *Pontia chloridice* (Hübner, 1813) eind augustus/begin september wordt hier voor het eerst uit Griekenland gemeld. De soort was gewoon in twee vindplaatsen, de ene in het centraal Rhodopengebergte, de andere in het oostelijk deel van deze bergketen, telkens dichtbij de Bulgaarse grens. De versheid van alle exemplaren toonde aan dat het niet ging om overblijvers van de tweede generatie die normaal van juni tot midden juli vliegt. Bovendien was de groene tekening op de onderzijde van de achtervleugels donkerder dan in de zomerexemplaren.

Résumé. Des exemplaires frais de *Pontia chloridice* (Hübner, 1813) ont été observés pour la première fois en Grèce fin août/début septembre. L'espèce était commune dans deux localités, la première dans les Rhodopes centrales, et l'autre dans la partie orientale de la même montagne, toujours près de la frontière bulgare. La fraîcheur de tous les exemplaires montre qu'il ne s'agit pas d'exemplaires tardifs de la deuxième génération qui vole normalement de juin à mi-juillet. De plus, la couleur verdâtre des dessins en dessous des ailes postérieures était plus foncée que dans les exemplaires d'été.

Key words: Pieridae – *Pontia chloridice* – Greece –Thráki – Rodhópi – Voltinism.

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Introduction

Pontia chloridice (Hübner, 1813) is a butterfly with a very limited distribution in Europe, its colonies inhabiting only the Balkan Peninsula, where the species is generally considered rare and extremely local. In Greece it has been reported so far from three separate localities, all of which are in the NE extremity of the country (Thráki region) (Fig. 1, black circles). Two of these localities lie in the Évros prefecture at an altitude of 100–200 m, and the third one in the Rodhópi prefecture (central Rodhópi Mts.) at an altitude of 600–700 m. The butterfly's habitat is invariably associated with dry river beds covered with white rounded rocks and pebbles.

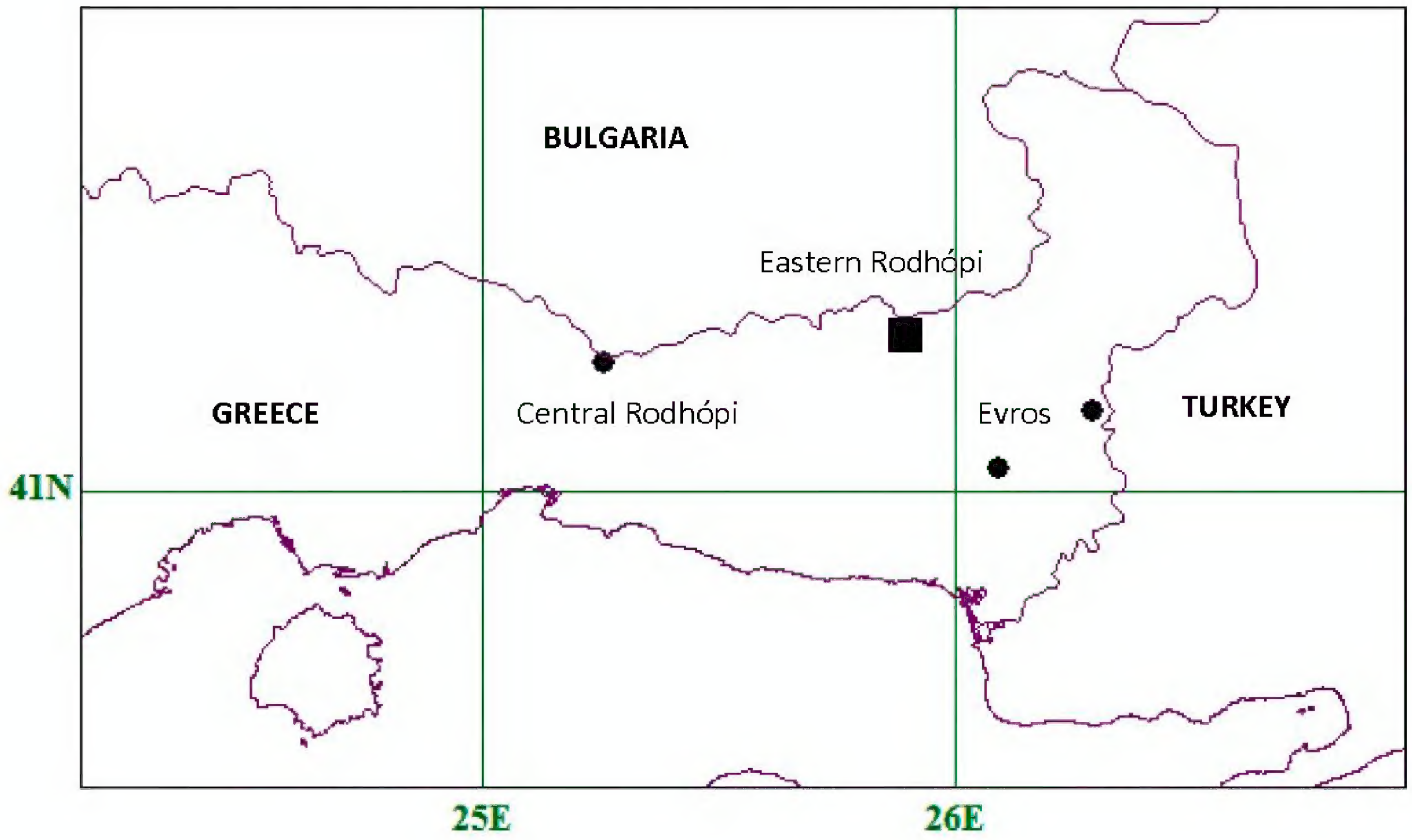

Fig. 1. Known geographic distribution of *Pontia chloridice* in Greece. Black circles correspond to already known colonies, black square to newly discovered location.

The Greek colonies of *P. chloridice* have been monitored by Greek lepidopterists for more than a decade, and it has been found that the butterfly's first generation normally flies from end March to mid-May (depending on altitude), and its second one is on the wing from late June to late July. In both these generations the butterfly appears in small to fair

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numbers, never giving the impression of being a common species.

Flight period and voltinism as recorded in literature

A lot of different views have been expressed in literature with respect to the number of broods per year for *P. chloridice*. These refer to populations ranging from the Balkans in Europe all the way to Mongolia. As, however, it has been shown in Coutsis (2014) that the population from Lake Balkhash, Kazakhstan actually is not *P. chloridice*, but instead the similar by wing characters *Pontia beckerii* (Edwards, 1871), it has been decided to exclude flight period and voltinism records for all geographic areas other than those for which the identity of *P. chloridice* has been established on the basis of its larval characters.

The following information already exists in literature regarding the flight period and voltinism of *P. chloridice*:

– Higgins & Riley (1980: p. 27) for Balkans: "April/May and June in two broods."
– Abadjiev (1992: vol. 1, p. 41) for Bulgaria: "To my opinion *P. chloridice* is a trivoltine species. The first generation appears in March, the second in June, but it is very possible that a third brood (in September) will be discovered."
– Hesselbarth *et al*. (1995: vol. 1, p. 433) for Turkey: "Die Falter treten je nach den klimatischen Verhältnissen des Biotops in zwei (Mai/Juni und Juli/August) oder in drei (März/April, Juni/Juli und August/September) Generationen auf, die sich mehr oder weniger überlappen."
– Tolman & Lewington (1997: p. 42) for Balkans: "Bivoltine. Mid April/late May and June/July in prolonged emergence."
– Tolman (2001: p. 17) for Balkans: "April – July in two prolonged overlapping broods."
– Makris (2003: p. 110) for Cyprus: "The adult butterflies start to emerge in March and are on the wing until November in at least three generations."
– Lafranchis (2004: p. 89) for Balkans: "Bivoltine: April – July."
– Pamperis (2009: p. 96) for Greece: "From April to July, in two generations (third not observed)."
– Tshikolovets (2011: p. 120) for Balkans, Turkey, Cyprus: "multivoltine; from April to November according to altitude and locality, usually May – August."

Although reports of a possible third generation are mentioned in some of the references above, actual pictures of specimens flying in autumn are shown only in Makris (2003). However, since the butterflies are displayed live, they are not useful for detailed description or comparison to earlier broods, because the insects are not set. Moreover, there is no clear evidence that broods are in fact chronologically distinct, as opposed to likely prolonged, overlapping ones. The author claims that only the '...adults of the first generation have darker green colours and more extensive black markings than those of succeeding generations', thus inferring that summer and autumn (if existent) broods do not differ morphologically. In any case, geographic and climatic conditions in Cyprus and Thráki are entirely different, meaning that direct parallelism could possibly be misleading.

Recent late summer / early autumn records of *P. chloridice* for Greece

On August 17, 2013 the first author visited an area in the Eastern Rodhópi Mts., NE of the city of Komotiní (Fig. 1, black square), located at an altitude of 850 m. To his great astonishment, he collected three perfectly fresh specimens of *Pontia chloridice*, two of which were males and one a female. Their excellent condition clearly suggested that they were not remnants of the second brood, but instead representatives of a third emergence. This condition prompted the first author to also revisit the Central Rodhópi locality already previously visited on July 14, where the butterfly had been found in fresh condition and in typically small numbers. Indeed, on August 19, 2013, six very fresh males were captured there at 600-700 m. Moreover, on September 1 of the same year ten more males and two females were further collected, almost all of them in mint condition. The butterfly was unexpectedly very numerous, by far outnumbering any other syntopic species. Such a situation had never been observed in the past.

The HW underside greenish markings

These are complete and dark in first brood individuals (Figs. 2–5). In the second brood they are sometimes intermixed with yellow, especially along the veins, making them appear lighter greenish, and are often incomplete (Figs. 6–9) however there are a few individuals that resemble first brood ones. In the third emergence the situation is rather puzzling. On the average, the August/September specimens demonstrate intermediate characteristics, as shown in Figs. 10–17. Specifically, the green shade is quite as dark as in the first generation however the white areas are more extensive. A study of the complete series of captured material reveals that individual variation is quite broad, with extreme cases featuring characters almost overlapping morphologically with those of both earlier broods. For instance, the male specimen shown in Figs. 14, 15 is very scantily coloured on HW underside, whereas the male specimen shown in Figs. 16, 17 has its HW underside almost as dark as in the spring generation. Furthermore the HW underside of the female shown in Figs. 12, 13 is almost identical to that of first generation counterparts.

Figs. 2, 3. *Pontia chloridice* ♂, first generation. Greece, Évros river basin, 150 m, 29.iv.2007. 2. Upper side. 3. Underside. – Scale bar: 1 cm.

Figs. 4, 5. *Pontia chloridice* ♀, first generation. Greece, Évros river basin, 150 m, 29.iv.2007. 4. Upper side. 5. Underside. – Scale bar: 1 cm.

Figs. 6, 7. *Pontia chloridice* ♂, second generation. Greece, Central Rodhópi Mts., 500 m, 14.vii.2013. 6. Upper side. 7. Underside. – Scale bar: 1 cm.

Figs. 8, 9. *Pontia chloridice* ♀, Second generation. Greece, Central Rodhópi Mts., 650 m, 4.vii.1994. 8. Upper side. 9. Underside. – Scale bar: 1 cm.

Conclusions

Clearly all that has been said under the previous heading cannot be attributed to temperature conditions since, if this were the case, the dark HW underside form, usually associated with subjection of immature stages to low winter temperatures, would not have made its appearance in the second brood and the third emergence, both of which are not affected by such temperatures. All this leads to two possible hypotheses: either the HW underside greenish marking condition is affected by humidity factors of microclimatic origin rather than temperature, in which case the third emergence could very well be considered as representing a clear-cut third brood, or individuals with dark HW underside greenish markings, flying other than in spring, represent retarded emergences of butterflies whose immature stages have indeed been subjected to low winter temperatures. However, the synchronous appearance of both HW underside morphs makes this hypothesis rather improbable.

It can only be hoped that future breeding experiments will eventually give a final answer about the true nature of the *P. chloridice* yearly third emergence.

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The authors would like to express their sincere gratitude to Prof. Anastasios D. Papatsoris, of the Technological Education Institute of Kendrikí Makedhonía for taking the pictures of most specimens, and Mrs. Olga Aroglou for her assistance in photo processing.

The map in Fig. 1 was created with DMAP for Windows, version 7.2. (http://www.dmap.co.uk

Figs. 10, 11. *Pontia chloridice* ♂, third emergence. Greece, Central Rodhópi Mts., 600 m, 1.ix.2013. 10. Upper side. 11. Underside. – Scale bar: 1 cm.

Figs. 12, 13. *Pontia chloridice* ♀, third emergence. Greece, Central Rodhópi Mts., 600 m, 1.ix.2013. 12. Upper side. 13. Underside. – Scale bar: 1 cm.

Figs. 14, 15. *Pontia chloridice* ♂, third emergence. Greece, Central Rodhópi Mts., 500 m, 19.viii.2013. 14. Upper side. 15. Underside. – Scale bar: 1 cm.

Figs. 16, 17. *Pontia chloridice* ♂, third emergence. Greece, Central Rodhópi Mts., 500 m, 19.viii. 2013. 16. Upper side. 17. Underside. – Scale bar: 1 cm.

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On the status of *Bembecia zebo* Špatenka & Gorbunov, 1992; *Bembecia pamira* Špatenka, 1992; *Bembecia kreuzbergi* Špatenka & Bartsch, 2010 and *Bembecia martensi* Gorbunov, 1994 (Lepidoptera: Sesiidae)

Theo Garrevoet & Walter Garrevoet

Abstract. Based on external morphology and DNA analysis, *Bembecia pamira* Špatenka, 1992 appears to be conspecific with *Bembecia zebo* and is considered here as a subjective junior synonym of the latter. The name priority is discussed since both taxa were described in the same year. Additionally, the DNA analysis demonstrates a similar profile to *Bembecia kreuzbergi* Špatenka & Bartsch, 2010 but this species shows clear differences in external morphology, especially in the female, and therefore its status as bona species appears justified. Also *Bembecia martensi* Gorbunov, 1994 is reviewed briefly. Illustrations of most of the discussed species are shown together with the genitalia preparations, when available.

Samenvatting. Gebaseerd op de externe morfologie en DNA analyses blijkt *Bembecia pamira* Špatenka, 1992 conspecifiek te zijn met *Bembecia zebo* Špatenka & Gorbunov, 1992 en wordt hier als een subjectief junior synoniem van *Bembecia zebo* beschouwd. De prioriteit in naamgeving wordt ook besproken vermits beide soorten hetzelfde jaar beschreven werden. De DNA analyse toonde ook een zeer gelijkend profiel voor *Bembecia kreuzbergi* Špatenka & Bartsch, 2010 maar deze soort vertoont duidelijke verschillen in externe morfologie, vooral bij het wijfje, en daarom wordt de status van deze soort als bona species behouden. Ook *Bembecia martensi* Gorbunov, 1994 wordt kort behandeld. Afbeeldingen van de meeste van de besproken soorten worden getoond, samen met de beschikbare genitaalstructuren.

Résumé. Selon une étude de la morphologie externe et des analyses ADN, *Bembecia pamira* Špatenka, 1992 semble être conspécifique avec *Bembecia zebo* Špatenka & Gorbunov, 1992 et est donc considérée ici comme synonyme subjectif plus récent de *Bembecia zebo*. La priorité des noms est discutée aussi parce que les deux espèces ont été décrites au cours de la même année. L'analyse ADN montrait aussi un profil semblable à celui de *Bembecia kreuzbergi* Špatenka & Bartsch, 2010 mais cette espèce montre des différences claires dans la morphologie externe, surtout chez la femelle, et le statut spécifique de ce taxon est donc retenu. *Bembecia martensi* Gorbunov, 1994 est discuté brièvement. La plupart des espèces discutées, ainsi que les genitalia disponibles, sont figurés.

Key words: Tajikistan – Pamir – Sesiidae – *Bembecia* – *zebo* – *pamira* – *kreuzbergi* – *martensi*.

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Abbreviations

MWM – Museum Witt München
CDB – collection of D. Bartsch
CTG – collection of T. & W. Garrevoet
COG – collection of O. Gorbunov
CAL – collection of A. Lingenhöle

Introduction

The genus *Bembecia* Hübner, 1819 has distribution hot spots in the Mediterranean area and Central Asia. In the past, many species were described from the latter area but recently several more new taxa were discovered (Bartsch & Špatenka 2010, Špatenka & Bartsch 2010, Stalling et al 2010, Garrevoet & Garrevoet 2011, Garrevoet & Lingenhöle 2011, Lingenhöle & Bartsch 2011, Stalling et al 2011). All species of the genus develop over one or two years in the roots or lower parts of the stems of various species of Fabaceae and have a reduced, non-functional proboscis.

After an expedition into the Pamir region (Gorno Badachstan) in Tajikistan (Central Asia), studying the collected material, especially within the genus *Bembecia*, the authors attention was drawn to *Bembecia pamira* Špatenka, 1992. This species showed a striking similarity in external morphology to *Bembecia zebo* Špatenka & Gorbunov, 1992. Therefore, a more thoroughgoing investigation of external morphology, genitalia structure and DNA profile appeared necessary.

The DNA results, performed in Guelph, Canada as part of the BOLD project, together with morphological resemblance, caused the authors to include also *Bembecia kreuzbergi* Špatenka & Bartsch, 2010 and *Bembecia martensi* Gorbunov, 1994 in this research. Thus the aim of this paper is to clarify the taxonomic status of *B. pamira* and *B. zebo* and to provide short notes on that of *B. kreuzbergi* and *B. martensi*.

Material

Types:

- *B. pamira* (Figs 13–14), 'ASIA centralis, Pamir 3550 m, Sarez ozero, Ljangar Fluss, 26.7.1985'; 'Holotypus ♀, K. Špatenka des. 1989' (MWM).
- *B. zebo* (Figs 1–2), 'USSR-Tadjikistan, Turkestan-chain, Kumbel 3000-3200m, 39,34N 68,33E, 15.-21.7.1987, e.l., K. Špatenka lgt.', 'Holotypus ♂, K. Špatenka des. 1989' (MWM).
- *B. zebo* (Figs 9–10, 'USSR-Tadjikistan, Turkestan-chain, Kumbel 3000-3200m, 39,34N 68,33E, 15.-21.7.1987, e.l., K. Špatenka lgt.', 'Paratypus ♀, K. Špatenka des. 1989' (MWM)
- *B. kreuzbergi* (Figs 5–6), 'Holotypus ♂, SO Usbekistan, Babatag Gebirge, Zar Kamar, 38°06N, 68°10O, 1250m, 29.V.2004, K. Špatenka leg.' (MWM).
- *B. kreuzbergi* (Figs 15–16), 'Paratypus ♀, SO Usbekistan, Babatag Gebirge, Zar Kamar, 38°06N, 68°10O, 1250m, 29.V.2004, K. Špatenka leg.' (MWM).

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B. martensi (Figs 7–8), 'Holotypus ♀, Kirgizstan, Alashtau Mts., Ermendy, N 41°15', E 72°40', 1550 m, 25-26.V.1993, ex l., leg. O. Gorbunov.' (COG).

B. martensi (Figs 17–18), 'Paratypus ♂, Kirgizstan, Alashtau Mts., Ermendy, N 41°15', E 72°40', 1550 m, 25-26.V.1993, ex l., leg. O. Gorbunov.' (COG).

Additional material of *B. zebo*: all specimens from Tajikistan (CTG)

Region Sughd

Iskander Kul, 2350 m, N 39° 5' 18.8" E 68° 23' 55.0", 13.vii.2010, 11♂-9♀.

Iskander Kul, 2350 m, N 39° 5' 16.3" E 68° 24' 5.9", 01.viii.2010, 6♂-5♀.

Iskander Kul, 2400 m, N 39° 2' 49.5" E 68° 18' 24.1", 05.viii.2010, 1♂.

Anzob Pass (North side), 2200 m, N 39° 9' 6.6" E 68° 50' 46.5", 17.vii.2010, 2♂.

Anzob Pass (North side), 2200 m, N 39° 9' 5.7" E 68° 50' 46.8", 07.viii.2010, 1♂.

Shahriston Pass, 2850 m, N 39° 34' 20.9" E 68° 33' 15.2", 20.vii.2010, 1♂-1♂ dead pupa.

Childara, 1875 m, N 38° 51' 44.8'' E 70° 20' 29.6'', 19.vii.2011, 2♂.

Region of Republican Subordination

Rufigar, 2100 m, N 39° 07' 29.7'' E 69° 25' 13.9'', 21.vii.2009, 1♂.

Magov,1500 m, N 38° 41' 18.1'' E 69° 05' 55.6'', 08.vii.2010, 1♂.

Sangvor, 2300 m, 50 km S of Jirgatol (Dzergatol), N 38° 44' 53.4'' E 71° 14' 07.0'', 15.vii.2011, Ex larva, 4♂-2♀. Moths emerged between 27.vii.2011 and 06.viii.2011. (Figs 3–4 ♂and 13–14 ♀).

Garm, 1950 m, N 39° 00' 30.8'' E 70° 28' 07.9'', 29.vii.2013, 1♂.

Anzob Pass (South side), 2450 m, N 39° 03' 59.7" E 68° 51' 00.0", 25.vii.2009, 5♂.

Anzob Pass (South side), 2400 m, N 39° 03' 52.3" E 68° 50' 56.4", 29.vii.2010, 5♂.

Anzob Pass (South side), 2575 m, N 39° 04' 13.6" E 68° 51' 01.1", 23.vii.2011, 1♂.

Anzob Pass (South side), 2850 m, N 39° 04' 30.0" E 68° 51' 02.4", 26.vii.2011, 4♂.

Gorno Badachstan (GBAO)

Saghirdasht Pass (North side), 2225 m, N 38° 41' 57.9'' E 70° 43' 30.2'', 11.vii.2013, 3♂.

Saghirdasht Pass (South side), 1850 m, N 38° 32' 51.7'' E 70° 48' 01.6'', 12.vii.2013, 1♂; 27.vii.2013, 1♂.

Methods

Bembecia pamira was described from a single, rather poorly preserved female and no additional specimens have been collected since. From this holotype, kept in the MWM, the external morphology was carefully compared using detailed photographs of both upper- and underside with illustrations of both male (holotype) and female (paratype) of *B. zebo* (also in MWM). Additional *B. zebo* specimens, of both sexes, captured or reared during recent expeditions in Tajikistan and kept in several collections (CTG, CDB and CAL) were also included in this comparison.

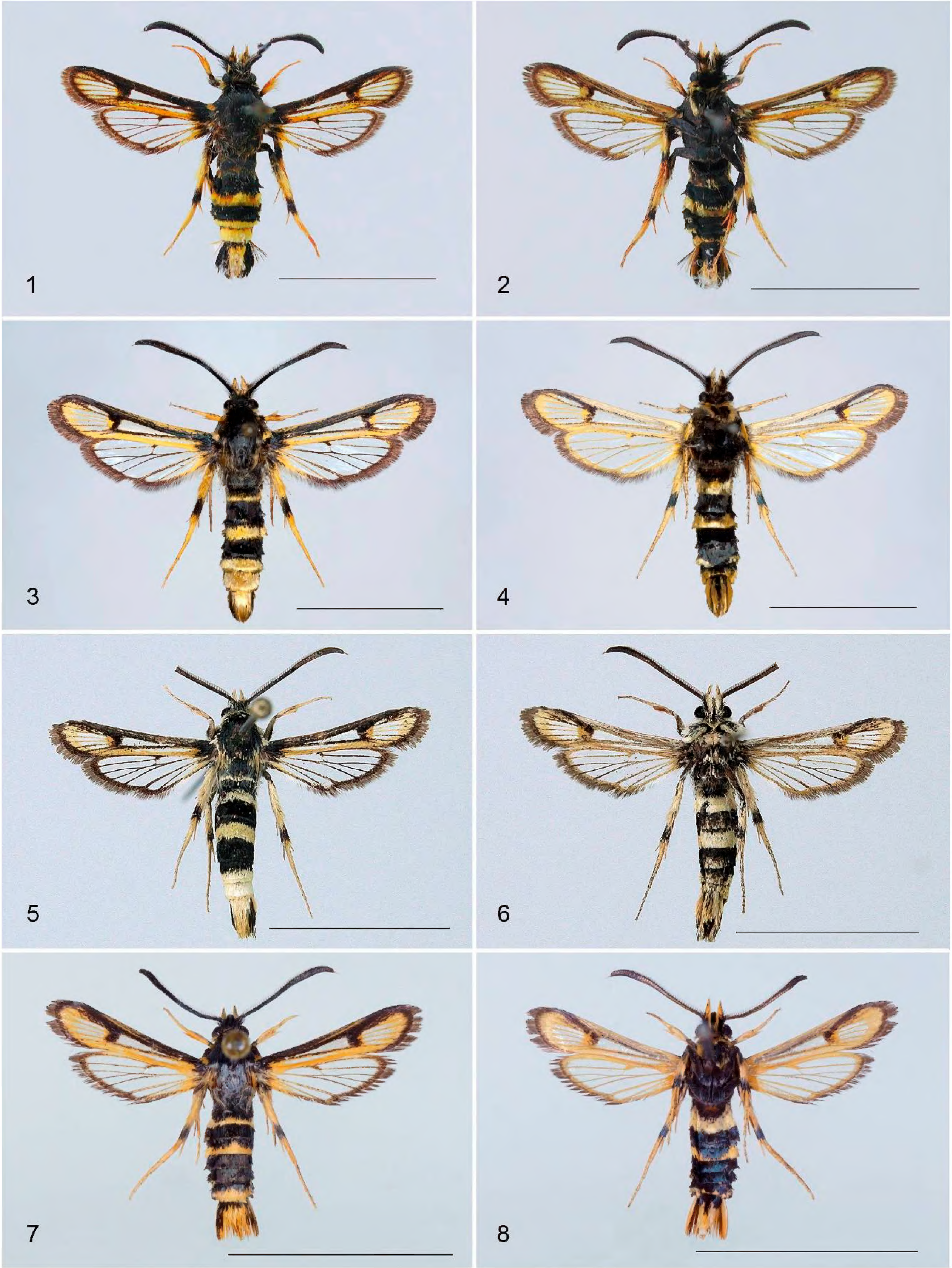
B. zebo was described from north-west Tajikistan, near the border with Uzbekistan, from bred material of both sexes from the host plant *Onobrychis echidna* Lipsky (Špatenka *et al.*, 1999). Since then, *B. zebo* has been captured, mainly with the use of pheromones, at different localities throughout Tajikistan. The best pheromone response was observed before noon using an old pheromone of unknown composition, for *Synanthedon myopaeformis* (Borkhausen, 1789) produced by the company BASF, Germany. Some individuals, including several females, were netted without the use of pheromones. Furthermore, at different localities, several specimens of both sexes were bred from *Hedysarum flavescens*, Regel & Schmalhausen, another species of Fabaceae. Infested plants had to be dug out from the hard and stony soil very carefully. The roots with larvae and pupae were kept in small containers and, once home, placed in terrariums containing a fine hydroculture granulate.

Preparations of genitalia of several specimens, including a dead pupa found in *Onobrychis echidna* at the type locality, were made using the standard techniques: maceration of the abdomen in 10% KOH, removal of the scales and cleaning in 70% ethanol. Genitalia of males were not stained, those of females were stained with Chlorazol Black, then embedded in Euparal on a cavity slide, males with opened valvae. DNA was extracted from a midleg of set specimens. DNA analysis (“Barcode” = 658 base pair sequences of COX1 mitochondrial DNA) of several Tajik *Bembecia* including the types of *B. zebo* and the type of *B. pamira* was carried out in Guelph (Canada). The PCR-primers used were LepF1 and LepR1; the distance model was Kimura 2 Parameter. For details see the “Barcode of Life Database” (BOLD) web pages (http://www.barcodinglife.com/views/login.php). The detailed data can be accessed with a login under the project “Global Sesiidae – Clearwing Moths of the World”.

Results

When comparing the external morphology of the female holotype of *B. pamira* with a female paratype of *B. zebo*, supplemented with additional material of the latter species collected more recently, the striking similarity in external morphology of both taxa became obvious. Because the genitalia structure of the *B. pamira* type has not been examined, this auxiliary could not be included into the comparison but often the genitalia in this group of Central Asian *Bembecia* do not provide useful differential criteria anyway. Nevertheless, the genitalia of both sexes of *B. zebo* are depicted for completeness, but are adequately described in the original publication (Špatenka & Gorbunov, 1992).

The DNA analysis (BOLD, Guelph, Canada) (Fig. 28) confirmed the expectation that the taxa are conspecific and therefore *B. pamira* becomes a subjective junior synonym of *B. zebo*.



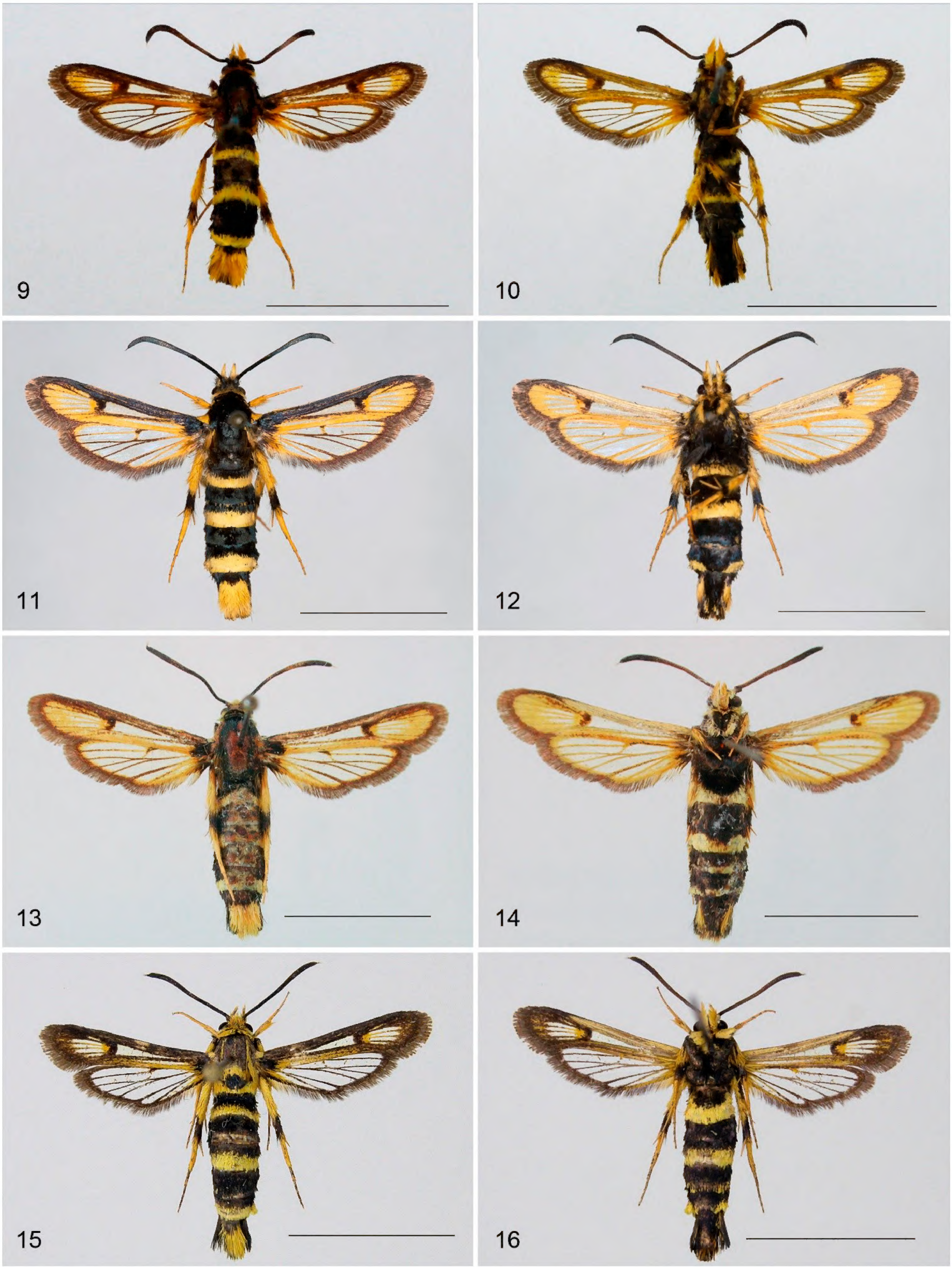
Figs 1–8. Males of *Bembecia* species, scale bars 10 mm.

1–2. *B. zebo* holotype, Tajikistan, Turkestan-chain, Kumbel Pass 3000-3200m, 15-21.VII.1987, e.l., leg. K. Špatenka (MWM).

3–4. *B. zebo*, Tajikistan, Region Republican Subordination, Sangvor, 50 km S of Dzergatol, N 38° 44' 53.4'' E 71° 14' 07.0'', 2300 m, 15.VII.2011, Ex larva, leg. T. Garrevoet (CTG).

5–6. *B. kreuzbergi* paratype, SE Uzbekistan, Babatag Range, Zar Kamar, N 38°06', E 68°10', 1250m, 29.V.2004, leg. K. Špatenka. (MWM).

7–8. *B. martensi* paratype, Kirgizstan, Alashtau Mts., Ermendy, N 41°15', E 72°40', 1550 m, 25-26.V.1993, ex. l., leg. O. Gorbunov. (COG).



Figs 9–16. Females of *Bembecia* species, scale bars 10 mm.

9–10. *B. zebo* paratype, Tajikistan, Turkestan-chain, Kumbel Pass 3000–3200m, 15–21.VII.1987, e.l., leg. K. Špatenka (MWM).

11–12. *B. zebo*, Tajikistan, Region Republican Subordination, Sangvor, 50 km S of Dzergatol, N 38° 44' 53.4'' E 71° 14' 07.0'', 2300 m, 15.VII.2011, ex larva, leg. T. Garrevoet (CTG).

13–14. *B. pamira* holotype, Tajikistan, Pamir, Sarez ozero, Ljangar River, 3550 m, 26.VII.1985, K. Špatenka des. 1989 (MWM).

15–16. *B. kreuzbergi* paratype, SE Uzbekistan, Babatag Range, Zar Kamar, N 38° 06', E 68° 10', 1250 m, 29.V.2004, leg. K. Špatenka. (MWM).

Figs 17–18. Females of *Bembecia* species, scale bars 10 mm.

17–18. *B. martensi* holotype, Kirgizstan, Alashtau Mts., Ermendy, N 41°15', E 72°40', 1550 m, 25-26.V.1993, ex l., leg. O. Gorbunov. (COG).

As both taxa were described in the same year, albeit in different journals, the problem of priority needed to be solved. *B. pamira* was described in the French journal Alexanor **17**(7), 1992, giving the publication date and *B. zebo* was described in the Austrian journal Entomofauna **13**(23), 1992 giving "Ansfelden 20. September 1992" as publication date.

Here the ICZN code is important: Art. 8.1.2 is not relevant here since both journals are published in a correct way but Art. 21.2. is important: "The date of publication specified in a work is to be adopted as correct in the absence of evidence to the contrary".

Although the latter journal arrived much later at several libraries – because the issues are sent to exchange libraries only once or twice a year to save postal charges – the publisher mentions he did send separata to some addressees even before the mentioned publication date. According to Art. 21.8.1, these are also valid as publication date, because the paper was published before the year 2000. So, at least 20 September 1992 can be considered as the valid publication date for *B. zebo.*

Because the title page of the specified Alexanor issue mentions "juillet-septembre 1992", Art. 21.3.1 stipulates the last day of the period mentioned has to be adopted as the publication date which in this case is 30 September 1992. Furthermore, regular subscribers to this journal indeed received the issue in the first half of October. Therefore, priority has to be given to the taxon name *B. zebo.*

In the DNA analysis, *B. kreuzbergi* was also included as this species showed a very similar pattern to that of *B. zebo*. The external morphological features, however, show obvious differences, especially in the female, which are clearly described in the original publication (Špatenka & Bartsch 2010). The colour of the metathorax is one of the most obvious ones: it is yellow in *B. kreuzbergi* and black in *B. zebo.* Therefore, notwithstanding the DNA results, the status of *B. kreuzbergi* is retained as bona species. For the integrity and comparison, illustrations of both sexes of *B. kreuzbergi* are given here (Figs. 5–6 and 15–16).

Based on both genital structure (not figured) and position in the DNA tree, *B. martensi* Gorbunov, 1994 also belongs to the same species group and has a similar general external appearance. However, it can be distinguished from *B. zebo* by the ground colour, which is yellow-orange instead of lemon yellow. Additionally, the markings on the dorsal side of the thorax are different, with a row of orange hair like scales on each side of the mesothorax and metathorax, which are absent in the other species. Furthermore, *B. martensi* has a small band on abdominal segment 1 which broadens significantly laterally, which is not the case in *B. kreuzbergi* and which is altogether absent in *B. zebo*.

Variability

The specimens of *B. zebo* which have been studied vary little in colour intensity. In older specimens the bright yellow colouration on both body and wings becomes more bleached pale yellow. On the other hand, differences in size are considerable and not directly related to the locality. However, dependence on different hostplants may be responsible, as the specimens from the type locality are in average somewhat smaller than the ones from other localities where the species develops in *Hedysarum flavescens*.

Genitalia

B. zebo belongs to the widespread Central Asian species group that lacks the medial crista of the gnathos and has a subdistal gap among the setae on the crista sacculi of the valva. The genitalia of both sexes are adequately described in the original description. In the male, the most important characteristics are the well-developed scopula androconialis, the absence of the crista medialis and the two groups of larger setae on the dorsal side of the crista sacculi. In the female, the slim, weakly sclerotised and funnel-shaped ostium bursae, together with the slender antrum and the reduced ductus bursae are the main characteristics.

As expected, since *B. kreuzbergi* belongs to the same species group, this species shows no significant differences in the male genitalia from those in *B. zebo*. The female genitalia of *B. kreuzbergi* have not been studied.

Figs 19–21. Genitalia of *Bembecia* males. Scale bars 1 mm. **19.** *B. zebo* (prep. TG2011-003) from a dead but fully developed pupa from the type locality, Tajikistan, Shahriston Pass, 2850 m, N 39° 34' 20.9" E 68° 33' 15.2", 20.vii.2010 (CTG). **20.** *B. zebo* (prep. TG2011-004), Tajikistan, Iskander Kul, 2350 m, N 39° 05' 16.3" E 68° 24' 5.9", 01.viii.2010 (CTG). **21.** *B. kreuzbergi* paratype (Bartsch, GU-prep. 2009-34), SE Uzbekistan, Babatag Range, Zar Kamar, N 38° 06', E 68° 10', 1250m, 29.v.2004, leg. K. Špatenka. (MWM).

For completeness, illustrations of the genitalia of the males of *B. zebo* (Fig. 19–20) and *B. kreuzbergi* (Fig. 21) are included, as well as the genitalia of a female of *B. zebo* (Fig. 22).

Bionomics

At the type locality *B. zebo* occurs on dry and stony soil with cushion forming flora including *Onobrychis* and *Astragalus* species and other typical high altitude plants such as *Eremerus* (Špatenka & Gorbunov, 1992 and authors' observation). Here *B. zebo* lives in *Onobrychis echidna* (Špatenka et al., 1999). In localities where it lives in *Hedysarum flavescens* (Fig. 27), its occurrence is almost entirely restricted to valleys with large or even smaller riverbeds, erosion gullies and roadsides with sufficient humidity to sustain the growth of the hostplant.

Fig 22. Genitalia of *B. zebo* female (prep. TG2013-005). Scale bar 1 mm. Tajikistan, Iskander Kul, 2350 m, N 39° 5' 18.8" E 68° 23' 55.0", 2350 m, 13.VII.2010, leg. T., W. & J. Garrevoet (CTG).

At the type locality, the authors found only one dried dead pupa (genitalia investigated) in *Onobrychis echidna* and attracted only one male with pheromones, but the bionomics are well described in the original publication (Špatenka & Gorbunov, 1992). At other localities, where the species lives in *Hedysarum flavescens*, the larva apparently also lives two years in the root of the hostplant. Also here, prior to pupation, the larva constructs a short exit tube from the root to the soil surface, which is almost invisible. The pupal chamber is inside the upper part of the root. In culture, emergence of the imagines always took place in the morning which is most likely to be the case in nature also. The species appears emerge from mid-July to the second half of August, depending on altitude. Males are active from late morning to early afternoon. Females were captured in early afternoon flying near the host plant.

Distribution

B. zebo is known from the type locality in the Turkestan mountain range in Tajikistan and from several other locations in the western part of Tajikistan (Hissar-Alai) but also from localities in central Tajikistan including the Peter the First Range in the north-western Pamir and, as *B. pamira*, in the Pamir itself. Although it appears to be widespread, all currently known localities are in Tajikistan. However, it is considered likely to be present in neighbouring countries too.

Conclusion

Based on the results of the investigation of external morphology and DNA analysis of the *Bembecia* species discussed, *Bembecia pamira* becomes a subjective junior synonym of *Bembecia zebo*. Although *Bembecia kreuzbergi* and *Bembecia martensi* show strong resemblances in their DNA, and belong genitalmorphologically in the same (sub)group, there are clear enough differences in external morphology to justify the validity of both taxa. In this respect, the morphology of the genitalia of these species, together with that of several other Central Asian species which lack the medial crista of the gnathos and have a subdistal gap in the setae on the crista sacculi of the valva, does not fit nicely into the *Bembecia ichneumoniformis* ([Denis & Schiffermüller], 1775) subgroup (Pühringer & Kallies 2004). Raising a separate subgroup within the *ichneumoniformis* group should be considered.

Acknowledgements

The authors thank Daniel Bartsch, Franz Pühringer and especially Willy De Prins for their assistance with literature items. We also express our special gratitude to Daniel Bartsch for providing the pictures of some type specimens, the determination of the hostplant of B. zebo and some critical remarks. Oleg Gorbunov is thanked for providing pictures of type specimens of B. martensi and Thomas Witt and Harry Sulak for the pictures of the female paratype of B. zebo. We are also grateful to Franz Pühringer (St. Konrad, Austria) for his indefatigable efforts in organising and collecting the samples for DNA analysis in cooperation with BOLD (University of Guelph, Ontario, Canada). Finally, Barry Goater is thanked for linguistic revision.

Figs. 23-27. In vivo pictures of *B. zebo*, biotope and hostplant. **23.** *B. zebo* ♂, ex larva, Sangvor, 50 km S of Jirgatol (Dzergatol), N 38° 44' 53.4'' E 71° 14' 07.0'', 2300 m, 15.VII.2011; moth emerged on 03.VIII.2011. **24.** *B. zebo* ♀, same data; moth emerged on 05.VIII.2011. **25.** *B. zebo* exuvium protruding from the stem base of *Hedysarum flavescens*, same data. **26.** Biotope of *B. zebo* near Anzob Pass (south side), 4500 m. **27.** *Hedysarum flavescens*, a hostplant of *B. zebo*. The insert shows the characteristic seeds.

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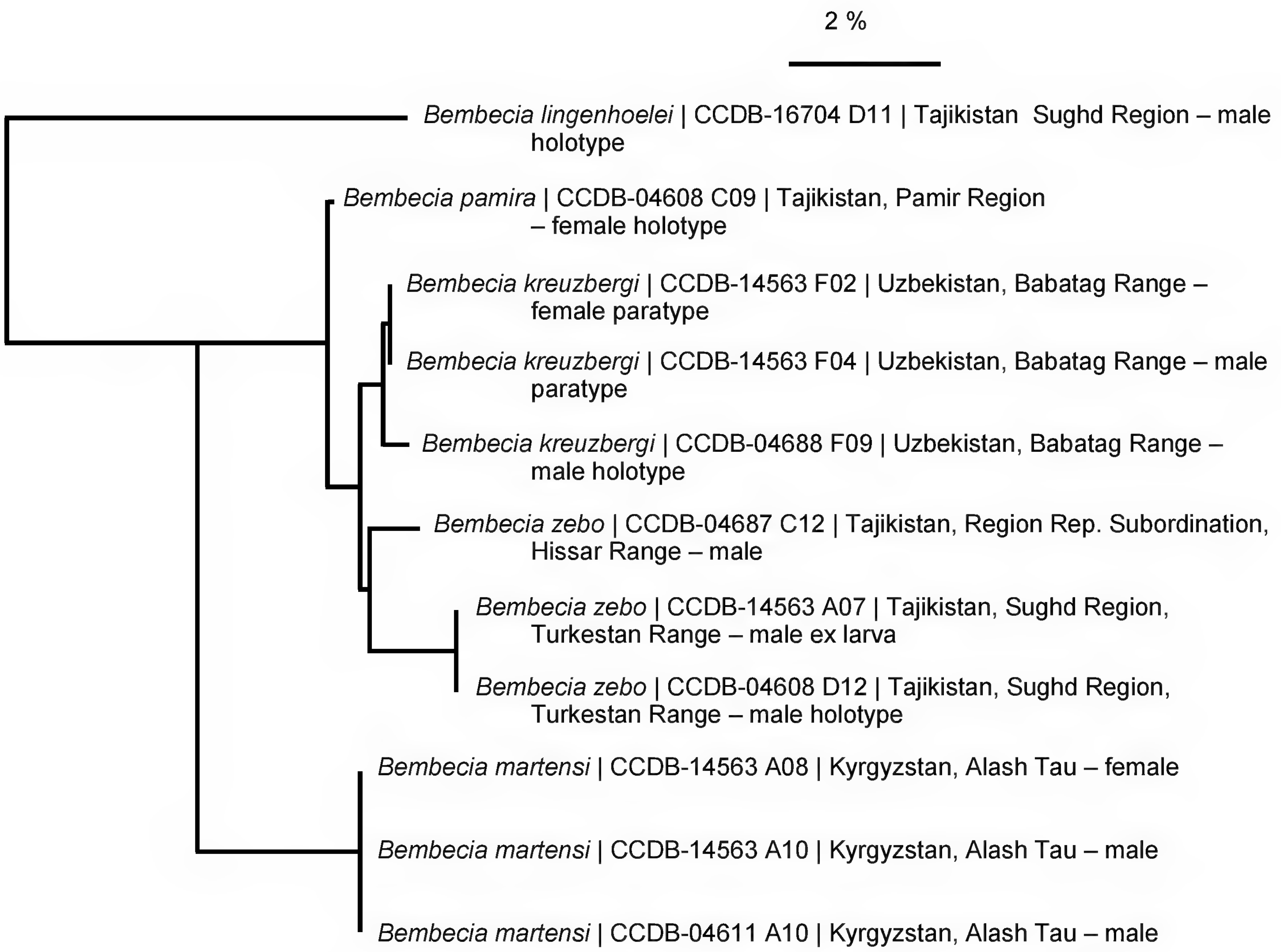

Fig. 28. Neighbour joining tree of DNA barcodes of *Bembecia* species, showing specimen registry numbers and localities of origin. *B. lingenhoelei* (Garrevoet & Garrevoet, 2011) is the outgroup.

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Two extreme forms of *Pseudochazara amymone* (Lepidoptera: Nymphalidae, Satyrinae) from Albania

Sylvain Cuvelier, Roland De Mol & Morten Schneider Mølgaard

Abstract. Two extreme forms of *Pseudochazara amymone* (Brown, 1976) from Albania are compared with the material studied in a recent variability analysis (Cuvelier & Mølgaard 2015). The results show that *P. amymone* can even be more variable than previously estimated but the key characters of *P. amymone* identified in Cuvelier & Mølgaard (2015) hold even for such extreme specimens.

Samenvatting. Twee extreme vormen van *Pseudochazara amymone* (Brown, 1975) uit Albanië worden vergeleken met het materiaal uit een recente analyse over de variabiliteit (Cuvelier & Mølgaard 2015). Dit toont aan dat *P. amymone* zelfs nog meer variatie kan vertonen dan voorheen werd ingeschat maar de sleutelkenmerken bij de identificatie van *P. amymone*, bepaald in Cuvelier en Mølgaard (2015), blijven ook bij dergelijke extreme exemplaren geldig.

Résumé. Deux formes extrêmes de *Pseudochazara amymone* (Brown, 1976) d'Albanie sont comparées avec du matériel provenant d'une analyse récente de la variabilité (Cuvelier & Mølgaard 2015). Les résultats montrent que *P. amymone* peut montrer encore plus de variation que l'on avait estimé bien que les caractères déterminants pour *P. amymone* identifiés par Cuvelier & Mølgaard (2015) restent toujours valables pour ces exemplaires extrêmes.

Key words. *Pseudochazara amymone* – extreme form – Albania.

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Introduction

Brown's Grayling, *Pseudochazara amymone* (Brown, 1976) was discovered in NW Greece in 1975 and for many years it remained the most enigmatic taxon in Europe. Its description (Brown 1976) was based on four males only and despite many searches, as far as known to us, no other material has ever since been sampled from Greece. Recently *P. amymone* was discovered in SE Albania by Eckweiler (2012) and since then different entomologists have observed this species in additional Albanian localities (Verovnik *et al*. 2014; Gascoigne-Pees *et al*. 2014; Cuvelier & Mølgaard 2015).

In July 2014, Roland De Mol visited different localities in the province of Korçë (Albania) and also collected a short series of *P. amymone* in Gjergjeviçë, one of the recently discovered localities where *P. amymone* flies in sympatry with the similar *Pseudochazara mniszechii tisiphone* (Brown, 1980). In a recent study (Cuvelier & Mølgaard 2015) the diagnostic features of *P. amymone* were assessed as well as the level of intraspecific variability. Two male specimens in the material of De Mol visually showed atypical phenotypes. It looked mandatory to test if this material could still be reliably distinguished based on the recently published diagnostic features (Cuvelier & Mølgaard 2015). The major differences of these two extreme forms are described and the two male butterflies are figured.

Comments

In the material sampled by De Mol two male specimens immediately attract the attention by the small size and the extreme coloration. For the first specimen (Fig. 1 a-b) all measurements fall in the low range of the studied series of Albanian *P. amymone* males (Cuvelier & Mølgaard 2015) but the butterfly is not an outlier. However, the upperside of this butterfly is very dark and the hindwing postdiscal band is almost completely lacking orange markings. This is in strong contrast with the studied *P. amymone* males from Albania and even more with the Greek type specimen (Brown 1976). The key characters of *P. amymone* (Cuvelier & Mølgaard 2015) are present. The second specimen (Fig. 1 c–d) is extremely small and different measurements are totally out of the expected range. The length of the forewing (apex to point of attachment to thorax) is only 21.5 mm whereas in the studied series mean ±2*SD is 22,43–25,49 mm (Fig. 2a). The width of the submarginal band on the forewing across the centre of the ocellus in S2 is only 5,0 mm and in the studied series the mean ±2*SD is 5,63–7,36 mm (Fig. 2b). Even when correcting this width of the submarginal band on the upperside forewing for the total length of the forewing it remains an extremely low value of 23,26% versus mean ±2*SD of 23,53–30,69% (Fig. 2c). Also the width of the submarginal band on the hindwing along vein 3 (Fig. 2d) of 6,0 mm is in the lowest values of the studied material but after correction for the total length of the forewing this is no longer relevant for this parameter. The key characters of *P. amymone* (Cuvelier & Mølgaard 2015) are also present in this second specimen.

Conclusion

The diagnostic characters (Cuvelier & Mølgaard 2015) of such atypical P. amymone are present in both specimens and the determination of these two butterflies poses no problem.

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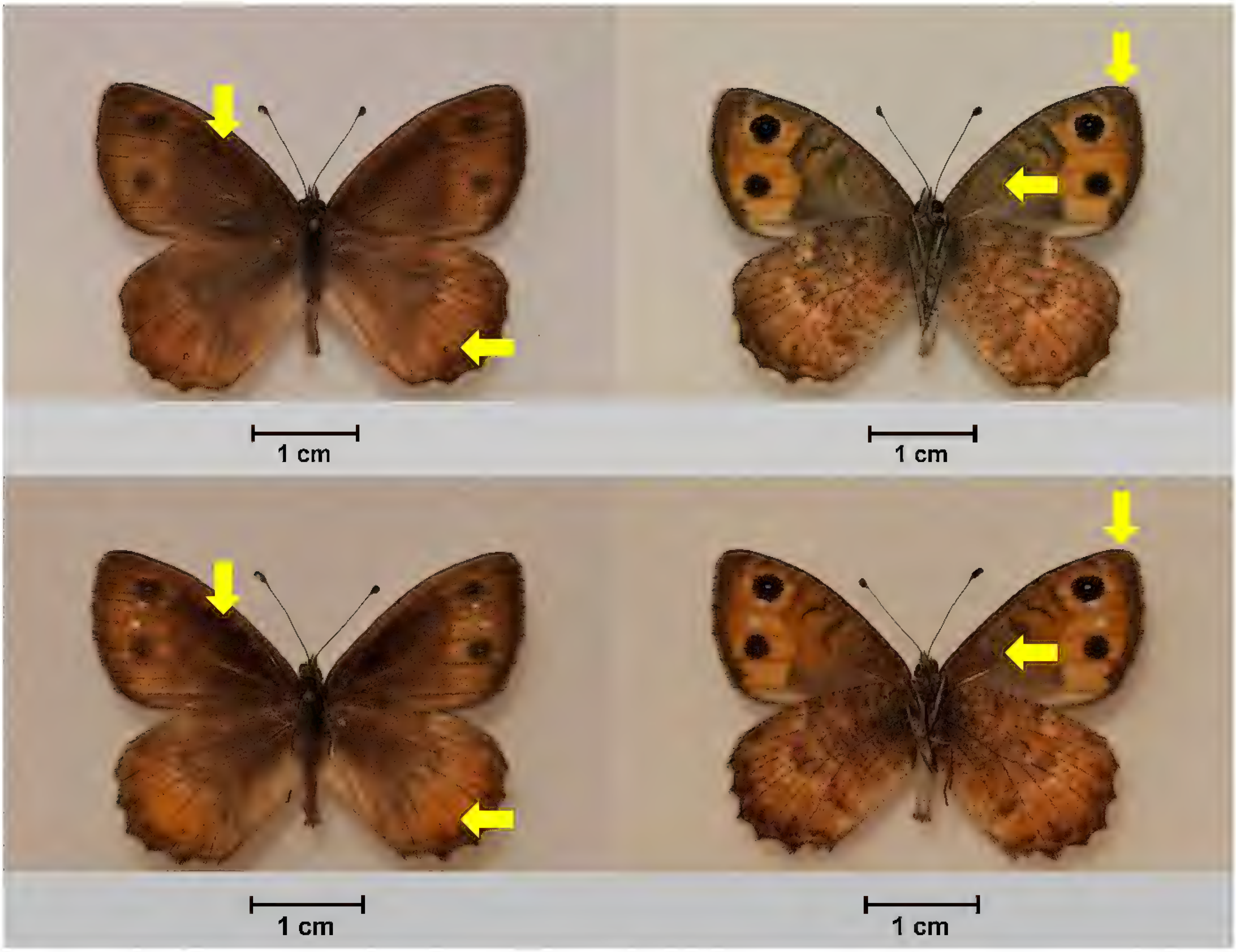

Fig. 1. Extreme forms of *Pseudochazara amymone*. **a–b** ♂ *P. amymone*, Albania, Gjergjeviçë, 15.vii.2014; **c–d** ♂ *P. amymone*, Albania, Gjergjeviçë, 16.vii.2014 (Leg. R. De Mol; Photos S. Cuvelier). The key characters are marked with yellow arrows.

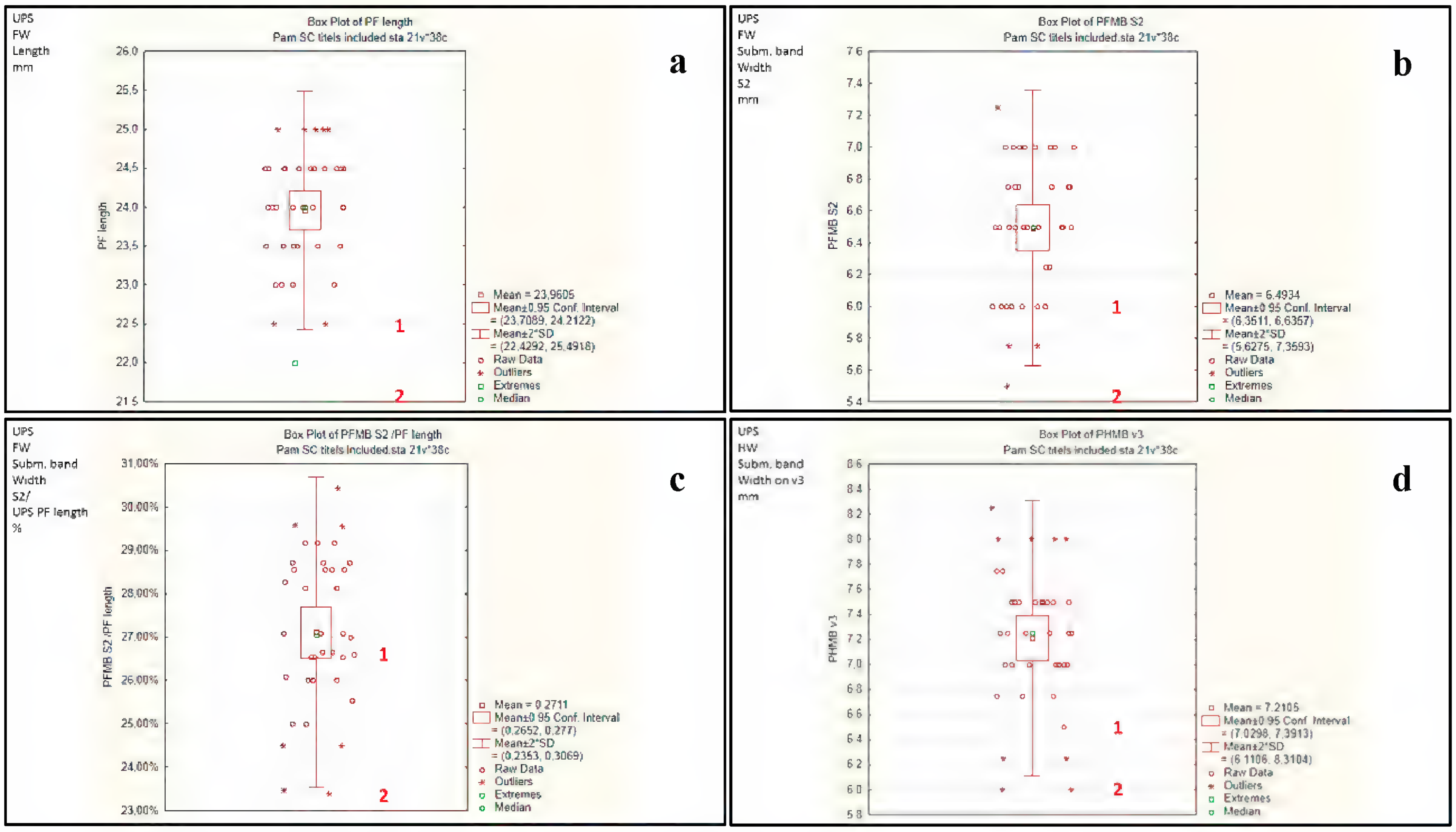

Fig. 2. Descriptive statistics (Boxplots) showing the differences of the two extreme forms when compared to the material analyzed by Cuvelier & Mølgaard (2015)

a.– Upperside forewing length; **b.–** Upperside forewing submarginal band width; **c.–** Upperside forewing submarginal band width corrected for upperside forewing length; **d.–** Upperside hindwing submarginal band width on vein 3.

Acknowledgement

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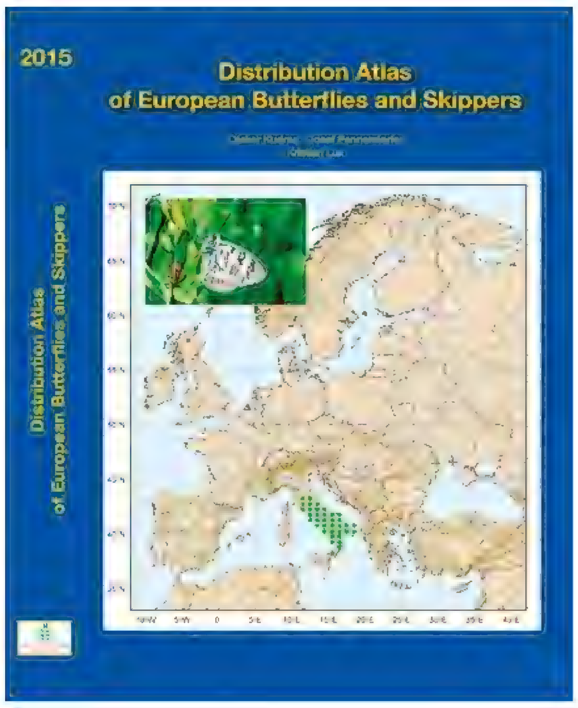
Bookbespreking

Kudrna O., Pennerstorfer J. & Lux K. 2015: *Distribution atlas of European butterflies and skippers*.
18 × 24,5 cm, 632 p., Wissenschaftlicher Verlag Peks e. K., Am Weiherlein 1, D-97523 Schwanfeld, Duitsland, www.wissenschaftlicherverlag.com, wissenschaftlicher-verlag-peks@t-online.de, gebonden 75,00 € + 10,00 € verzendingskosten (ISBN 978-3-938249-71-0).



In 2009 verscheen de eerste editie van de *Distribution atlas of European butterflies*, al snel gevolgd door een tweede uitgave in 2011. Ondertussen werden zoveel nieuwe gegevens opgetekend dat een derde publicatie zich opdrong. Wat onmiddellijk opvalt wanneer men dit boek te zien krijgt, is dat het veel luxueuzer uitgegeven is dan de vorige edities. Het is een honderdtal pagina's dikker, volledig in kleur gedrukt en het is voorzien van een wit en een blauw leeslint.

Na een nogal emotionele inleiding over de geschiedenis van het project door de eerste auteur, volgen hoofdstukken over de taxonomische en zoögeografische achtergrond met daarin o.a. checklists van genusgroep- en soortgroepnamen, een overzicht van het klimaat in het Holoceen en een indeling van de verschillende verspreidingspatronen.

De hoofdbrok van het hele boek is uiteraard voorbehouden aan de eigenlijke verspreidingskaartjes. Daarop is het voorkomen van de verschillende soorten aangeduid met stippen in drie kleuren: rood voor soorten die enkel waargenomen zijn vóór 1951, geel (1951–1980) en groen (na 1980). Onderaan elk kaartje staat nog wat info over de algemene verspreiding, de conservatiestatus en soms over de taxonomie.

Een foto van een adulte vlinder oogt fraai in de linkerbovenhoek, maar waarom kon een foto gevonden worden voor de erg zeldzame *Borbo borbonica* en niet voor b.v. de algemene *Carcharodus alceae*? De info over de verspreiding werd bekomen van ca. 450 medewerkers. Zoals bekend uit vorige edities wordt gebruik gemaakt van een systeem met "reference localities", zodat b.v. alle Belgische vindplaatsen worden geconcentreerd in 48 lokaliteiten. Dit systeem brengt toch heel wat onnauwkeurigheden met zich mee. Als voorbeeld kunnen enkele fouten vermeld worden, mij aangereikt door J. G. Coutsis: *Carcharodus flocciferus* wordt door twee stippen vermeld van de Peloponnesos terwijl honderden exemplaren door Coutsis op genitalia onderzocht alle bleken te behoren tot *C. orientalis*; *C. lavatherae* wordt aangeduid uit Zuid-Griekenland terwijl de soort enkel voorkomt in het uiterste noorden; *Parnassius mnemosyne* komt wel degelijk voor op het eiland Euboea terwijl een stip ontbreekt; *Colias alfacariensis* is aangeduid voor de Peloponnesos terwijl de meest zuidelijke vindplaats Mt. Olympos is op het Griekse vasteland; *Pieris krueperi* wordt aangeduid voor West-Kreta terwijl de soort daar niet voorkomt; *Cacyreus marshalli* wordt niet vermeld uit Griekenland terwijl de soort daar sinds enkele jaren erg gewoon is in de meeste steden, inclusief de eilanden; *Boloria graeca* krijgt een stip op de Peloponnesos terwijl de soort daar helemaal niet voorkomt; *B. selene* wordt niet vermeld uit Griekenland terwijl de soort er op verscheidene plaatsen in de Rhodopen voorkomt, enz. enz. Men vraagt zich af waarom de eerste auteur, wel verwijzend naar de kennis van J. G. Coutsis (p. 533), die lepidopteroloog niet heeft geraadpleegd of hem enkele kaartjes van Griekenland getoond.

De gebruikte taxonomie en nomenclatuur wijkt op vele plaatsen erg af van de gangbare in Fauna Europaea. Meestal gaat het om een subjectieve en eigenzinnige opvatting van de eerste auteur. Enkele voorbeelden: het taxon *loewii* wordt naar *Eumedonia* verplaatst en de taxa *hesperica* en *pylaon* naar *Kretania*; *Polyommatus amanda* wordt omgedoopt tot *P. icarius*; *P. eleniae* wordt gesynonymiseerd met *P. orphicus* enz. enz.

Achteraan het boek bevindt zich een summier overzicht van de dagvlinderverspreiding in de Azoren, Madeira en de Kanarische Eilanden. Tevens vindt men daar o.a. statistische info over de Europese dagvlinders, een lijst van alle "reference localities", een glossary en een overzicht van de geciteerde literatuur. De alfabetische index gaat een beetje schuil middenin deze hoofdstukken, maar dit wordt gecompenseerd door de alfabetische volgorde van alle kaartjes binnenin elke vlinderfamilie.

Een student van de Europese dagvlinderverspreiding moet dit boek wel raadplegen, maar zal toch telkens de kaartjes kritisch moeten interpreteren, zeker bij de "perifere" soorten.

Willy De Prins

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The Pygmy Skipper *Gegenes pumilio*: a new species to Bulgaria, and a confirmation of its occurrence in the eastern Balkan Peninsula (Lepidoptera: Hesperiidae)

Zdravko Kolev and Nikolay Shtinkov

Summary. This paper details the first definitive record of the subtropical, circum-Mediterranean skipper *Gegenes pumilio* (Hoffmannsegg, 1804) from Bulgaria. The find is significant not only on a national scale, but primarily because it is the first certain proof of the occurrence of *G. pumilio* in the central-eastern parts of the Balkan Peninsula. The characters distinguishing this species from its close congener *G. nostrodamus* (Fabricius, 1793) are reviewed and the differences in the male genitalia are clarified. Circumstances related to the ecology and conservation status of the species are also discussed.

Samenvatting. De eerste zekere waarneming in Bulgarije van de subtropische, circummediterrane soort *Gegenes pumilio* (Hoffmannsegg, 1804) wordt besproken. Deze vondst is niet alleen belangrijk op nationale schaal, maar vooral omdat ze het eerste bewijs is van het voorkomen van deze soort in de centraal-oostelijke delen van het Balkan schiereiland. De kenmerken die deze soort van de nauw verwante *G. nostrodamus* (Fabricius, 1793) onderscheiden worden herbekeken en verschillen in de mannelijke genitalia worden uitgelegd. Onderwerpen i.v.m. de ecologie en de bescherming van deze soort worden ook besproken.

Résumé. On rapporte la première observation définitive en Bulgarie de l'espèce subtropicale, circumméditerranéenne *Gegenes pumilio* (Hoffmannsegg, 1804). Cette observation est importante pas seulement à l'échelle nationale, mais aussi parce que c'est la première preuve définitive de l'occurrence de cette espèce dans la partie centre-est de la péninsule des Balkans. Les caractères distinctifs de cette espèce par rapport à son proche congénère *G. nostrodamus* (Fabricius, 1793) sont discutés et les différences dans l'appareil génital des mâles sont clarifiées. Des circonstances reliées à l'écologie et le statut de conservation de cette espèce sont discutés.

Keywords: Pygmy Skipper – Gegenes pumilio – Gegenes nostrodamus – male genitalia – Bulgaria.

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Introduction

Distribution. The Pygmy Skipper *Gegenes pumilio* (Hoffmannsegg, 1804) is a highly xerothermophilous skipper species, which in Europe is distributed almost exclusively in coastal areas of the Mediterranean (Tolman 1997, Settele *et al.* 2008). In the Balkan Peninsula, *G. pumilio* is narrowly confined to the coastal areas of the Adriatic and Aegean seas in Croatia, Bosnia-Herzegovina, Montenegro and Albania (Jakšić 1988, Lelo 2008, Lorković 1971, Misja 2005), but is more widespread in Greece (Pamperis 2009) which is the centre of distribution of this species in the mainland Balkan Peninsula. Thus, in the second edition of his treatise on the butterflies of Greece, Pamperis (2009) provides the overwhelming part of data points for the distribution of *G. pumilio* in the Balkan Peninsula. Most of the records of *G. pumilio* are from southern, western and central Greece; by contrast, records are markedly scarcer in northern Greece. Only four published records from northern Greece exist: lake Kerkini, Mikroklisoura and lake Vistonida in Greece's Macedonia province, and Megalo Rema in Thrace province (Pamperis, pers. comm. to Z. Kolev, 23.08.2013; the localities are shown in Fig. 1). Unfortunately none of these records is corroborated by visual or any other information apart from locality data, thus leaving the possibility for misidentification with its very similar congener *Gegenes nostrodamus* (Fabricius, 1793), which is more widespread in northern Greece and European Turkey (Pamperis 2009, Hesselbarth *et al.* 1995).

The lack of published data to definitively prove the species identity of any of these records is regrettable, because 'common knowledge' perpetuated by all popular butterfly guides published so far is that *G. pumilio* does not occur in the central-eastern parts of the Balkan Peninsula (e.g. Chinery 1989, Tolman 1997, Tolman 2001, Lafranchis 2004, Haahtela *et al.* 2011). Seemingly agreeing with the latter viewpoint is the lack of records of *G. pumilio* not only from European Turkey but also from the whole Aegean coast of Turkey north of Izmir (Hesselbarth *et al.* 1995, Baytaş 2007).

Published Bulgarian 'record'. *G. pumilio* has not been explicitly and reliably recorded from Bulgaria. There is, however, a single reference connecting *G. pumilio* to the country: a map depicting the European distribution of *G. pumilio*, where a single dot is plotted within the state borders of Bulgaria, but without any further information (Kudrna 2002, Settele *et al.* 2008, Kudrna *et al.* 2011, Gesellschaftt für Schmetterlingsschutz 2015). In our opinion, this 'record' is erroneously plotted, a misdetermination, or both. Our argumentation is as follows:

– Suitable conditions for the Mediterranean species of the genus *Gegenes* do not occur anywhere in the grid cell in question. Part of that area is occupied by high mountains (Rila, 2925 m), while the rest of the grid cell covers part of the upper Struma valley. The latter area is under only limited Mediterranean influence, and its climatic conditions cannot sustain any of the xerothermophilous butterfly species occurring in the

extreme southernmost part of Struma valley, such as *Gegenes nostrodamus*, *Erynnis marloyi* (Boisduval, [1834]), *Gonepteryx farinosa* (Zeller, 1847), *Anthocharis gruneri* (Herrich-Schäffer, [1851]), *Lycaena ottomana* (Lefebvre, [1830]), *Freyeria trochylus* (Freyer, [1845]), *Tarucus balkanicus* (Freyer, [1844]), *Pseudochazara anthelea amalthea* (Frivaldszky, 1845), *Hipparchia fatua* Freyer, [1844], or *H. senthes* (Fruhstorfer, 1908). The southern Struma valley is in the grid cell to the south of the plotted dot of *G. pumilio*. This discrepancy indicates that this ”record” may be erroneously plotted, most likely due to the flaws inherent in Kudrna's proprietary Reference Locality System (RLS) used for the project Mapping European Butterflies (MEB). These methodological flaws, which can lead to extreme cases of erroneous plotting of actual records, have been discussed in detail by Kolev (2003) and Fiedler (2011).

– It is notable that none of the published records of *G. nostrodamus* from SW Bulgaria (Gogov 1963, Lehmann 1990, Ganev 1983, Ganev 1984, Abadjiev 2001) has been plotted on Kudrna's map for *G. nostrodamus* in the first edition of the Atlas (Kudrna 2002). This indicates the possibility that the initial record for *G. pumilio* in the MEB database has resulted from misdetermination and misinterpretation of a published record for *G. nostrodamus*.

– Moreover, a competent reporter must have been aware of the significance of such a record as the species has not been previously reported for the country (Abadjiev 2001). Nevertheless, no further data have been published and the material on which the record was based remains unknown. In the absence of these data, it is clear that this record cannot be considered seriously.

Fig. 1. Known localities of *Gegenes pumilio* in the eastern Balkan Peninsula.
1: new record, Chuchuligovo village,
2: lake Kerkini,
3: Mikroklisoura,
4: lake Vistonida,
5: Megalo Rema (2–5: Pamperis, pers. comm. to Z. Kolev). Hatched area around record 1: potential range in Bulgaria. See text for details.

First record of *Gegenes pumilio* from Bulgaria

Material. 1♂, SW Bulgaria, lower Struma valley, Chuchuligovo village, 41°24'28"N, 23°21'51"E, ca. 100 m a.s.l., 02.08.2013, leg. et coll. Z. Kolev (location shown in Fig. 1; specimen pictured in Figs. 2a and 2b, genitalia in Fig. 3). The habitat is a dry sandy and gravelly riverbed with sparse ruderal vegetation dominated by *Marrubium peregrinum*, *Verbascum* sp., etc. (Fig. 2e).

Other noteworthy butterfly species recorded at this locality by the authors during a total of 13 visits between 19.08.2012–01.09.2012, 06.04.2013–02.08.2013 07.05.2014–11.11.2014, and 20.09.2015 include: *Gegenes nostrodamus*, *Carcharodus orientalis*, *C. lavatherae*, *Pyrgus cinarae*, *Zerynthia cerisy, Tarucus balkanicus*, *Kretania sephirus, Hyponephele lupina*, *Hipparchia senthes*, *H. fatua, Limenitis reducta*, etc. This is also the only confirmed locality of *Freyeria trochylus* in Bulgaria (Wetton 2012, Ignatov *et al.* 2013), although it is noteworthy that, thus far, we have failed to find the species there again, despite intensive search for it.

Circumstances. The herewith reported specimen of *G. pumilio* was found at ca. 9 a.m. on a hot day, with ambient temperature approaching 30°C by that time of the morning, in the course of a search for *G. nostrodamus* in the locality discovered for the latter species by the senior author in 2012. The *G. pumilio* male appeared suddenly, attracted to the sweaty boots of the senior author, and then proceeded to perch on dry pebbles which it probed with its extremely long proboscis for mineral salts. Finally, after a brief disappearance in the extremely fast flight typical of *Gegenes*, the specimen returned to feed on flowers.

Already during the first minute of photographing the specimen with wings closed on a pebble (Fig. 2b), the senior author noted the spotted hindwing underside and voiced a suggestion that this specimen might actually be *G. pumilio*. A careful comparison of photos of the specimen in question (Figs. 2a and 2b) and of *G. nostrodamus* from this and another nearby locality (Figs. 2c and 2d), as well as a comparison of the captured specimen with a male and a female of *G. nostrodamus* from Bulgaria (General Todorov village, V. Gashtarov leg., in coll. Z. Kolev) confirms that the former indeed belongs

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to *G. pumilio*. This is confirmed by a dissection and study of the male genitalia carried out by the senior author. The external and genital morphological differences between *G. pumilio* and *G. nostrodamus* will be dealt with below.

Fig. 2: a) *Gegenes pumilio*: male, SW Bulgaria, lower Struma valley, Chuchuligovo village, 100 m, 2.08.2013;

b) same data as (a);

c) *G. nostrodamus*: male, 1.09.2012, same data as (a);

d) *G. nostrodamus*: SW Bulgaria, lower Struma valley, Melnishka reka near Novo Konomladi village, 7.08.2007;

e) habitat of *G. pumilio* and *G. nostrodamus*, same data as (a). Photos: Z. Kolev.

Differentiating characters between *Gegenes pumilio* and *G. nostrodamus*

The only other species similar to *G. pumilio*, both morphologically and ecologically, is its congener, the Mediterranean Skipper *Gegenes nostrodamus* (Fabricius, 1793). In terms of ecology, the two have similar, predominantly coastal-Mediterranean distributions in Europe, with *G. nostrodamus* typically reaching further inland from the coast. However, where comparable data are available, contrary to expectations it is actually *G. pumilio* that reaches higher up in mountains: up to 1800 m a.s.l. in Greece, whereas *G. nostrodamus* is said not to exceed 1200 m there (Pamperis 2009). Despite the ecological similarities, few cases are known of the two species occurring together (Larson 1982, Coutsis & Olivier 1993, Hesselbarth *et al.* 1995).

The two *Gegenes* species differ constantly in both external and genital morphology (Coutsis & Olivier 1993). The external characters are as follows:

1. Size: *G. pumilio* is markedly smaller than *G. nostrodamus*. The forewing length of the Bulgarian *G. pumilio* male is 15.9 mm, while that of the available male nostrodamus in coll. Kolev is 16.8 mm.
2. Upperside colour: dark blackish brown in *G. pumilio*, lighter cinnamon brown in *G. nostrodamus*.

3. Markings on hindwing underside: distinct pale postdiscal spots are always present in *G. pumilio*, and absent (hindwing unmarked) in male *G. nostrodamus*.

4. Hair tuft at hindwing base: Along the costal edge of the hindwing, *G. pumilio* carries short, fine and sparse hair-like scales which are typically visible only upon close inspection, otherwise giving the impression of a smooth costal edge. By contrast, in *G. nostrodamus*, these scales are long, coarse and numerous, and form a tuft which can be clearly seen even at a distance, sometimes protruding well beyond the costal edge of the forewing (Figs. 2c and 2d).

We note that special care must be exercised with identifying photographs based on these characters, since their visibility depends strongly on lighting, condition of the specimen, and angle of viewing. The fourth character in particular, although often cited in butterfly guides (Tolman 1997, Haahtela *et al*. 2011), can be very misleading. For example, the senior author has a series of photos of the same *G. nostrodamus* specimen, taken only seconds apart from slightly varying angles due to the specimen moving around on the inflorescence. The tuft of scales is conspicuous in some photos (Fig. 2d), but entirely undetectable in others. Therefore, while its presence is proof of *G. nostrodamus*, its absence in and of itself may not be sufficient for determination.

For the purposes of this report, the senior author examined published illustrations of the male genitalia of *G. pumilio* (Coutsis & Olivier 1993, Jakšić 1998) and *G. nostrodamus* (Coutsis & Olivier 1993, Jakšić 1998, Zahm 2012). It was found that, in view of the characters observed in the genitalia of the Bulgarian material (Fig. 3) these limited sources apparently do not represent the full scale of character variation in either species. For a more comprehensive assessment, unpublished genitalia drawings of both species were kindly provided by J. G. Coutsis to the senior author. Based on all available data (in total 14 specimens of *G. pumilio* and 13 specimens of *G. nostrodamus*), it was concluded that the two species indeed differ constantly and markedly by certain characters in the valva, as follows:

1. Apical process (cucullus) of the valva. In view of the examined samples, and even by comparison with the illustrations provided therein, the description of this character in Coutsis & Olivier (1993) is incomplete and partly inaccurate. In fact, it appears that the descriptions for the two species have been swapped. The actual difference is as follows: in *G. pumilio*, the dentition of the cucullus is most sclerotized at the distal end, and consists of more irregularly sized teeth which generally decrease in size and degree of sclerotization toward the base of the valva. By contrast, in *G. nostrodamus*, the cucullus bears a roughly crescent-shaped crown of teeth, with the two endpoints being the most heavily sclerotized and most prominent. Besides, as noted by Coutsis & Olivier (1993), the cucullus in *G. pumilio* on average does not project as far beyond the tip of the valva as it does in *G. nostrodamus*.

2. The ventral (lower, in lateral view) edge of the valva: in *G. pumilio*, on average more strongly curved inward (concave) between the basal and middle thirds of its length. This character is here reported for the first time.

Further differences in other parts of the male genitalia besides the valva, e.g. in the shape and size of the cornuti of the penis, and the relative lengths of the saccus, uncus and tegumen, were also stated by Coutsis & Olivier (1993). The female genitalia of the two species, which likewise bear clear differentiating characters (Coutsis 2012), shall not be discussed here due to the lack of material of both species.

Fig. 3. Male genitalia of *Gegenes pumilio* and *G. nostrodamus*, lateral view. 1. Shape and dentition of the cucullus. 2. Ventral edge of the valva. The characters are described in detail in the text (© Z. Kolev).

Discussion

The present report provides the first definitive proof of the occurrence of *G. pumilio* in Bulgaria and in the wider region of this part of the Balkan Peninsula. With this record, the skippers of Bulgaria reach a total of 28 confirmed species, and the total of confirmed butterfly and skipper species in the country reaches ca. 217. This discovery has been entirely unexpected, in view of the fact that Bulgaria lacks a true Mediterranean zone (Kolev 2013) and the ambiguity of the few published records from north-east Greece (see above). Moreover, it must be pointed out that the presently reported record is in fact the northernmost record from this part of the Peninsula. This discovery lets us speculate that, in a similar manner, other butterfly species occurring in the Mediterranean zone of northern Greece might also be found in Bulgaria in the future, e.g. *Papilio alexanor*

Esper, [1799], *Archon apollinus* (Herbst, 1798), *Pyronia cecilia* (Vallantin, 1894), *Proterebia afra* (Fabricius, 1787), *Charaxes jasius* (Linnaeus, 1767), etc. The recent confirmation for Bulgaria of two other such species, viz. *Freyeria trochylus* (Ignatov *et al.* 2013) and *Cacyreus marshalli* (Butler, 1898) (Z. Kolev, pers. observ. in Melnik, 2013; Langourov & Simov 2014), also supports such expectations.

Yet more significant from a zoogeographical point of view is the fact that the present report confirms beyond doubt the occurrence of this Mediterranean species in the central-eastern part of the Balkan Peninsula. This suggests that *G. pumilio* is very likely to occur also in European Turkey, and perhaps also in the ex-Yugoslav Republic of Macedonia (F.Y.R.O.M.).

The two *Gegenes* species tend to occur in the same habitats in East Africa, the Arabian Peninsula, Levant (Larson 1982) and on the island of Crete (Coutsis & Olivier 1993) but apparently not so in Anatolia (Hesselbarth *et al*. 1995), despite their similar overall ranges. It is therefore very intriguing, from an ecological perspective, that both *Gegenes* species occur in the herewith reported locality at Chuchuligovo. This raises interesting questions about the interaction and possible ecological differences between the two species that could be addressed by further research.

The Pygmy Skipper is listed as "Not threatened" in the European Red List of Butterflies (Van Swaay *et al.* 2010); however its conservation status varies widely in individual European countries. While in Greece the species is considered "not threatened" (Pamperis 2009), it has been evaluated as "Critically Endangered" in France where it has not been observed since 1997 (UICN France *et al*. 2012). The decline is attributed to intensive urbanisation which has destroyed most of the species habitat along France's south-east Mediterranean coast. As discussed below, habitat destruction and degradation are likely the main threats to the Bulgarian population as well.

The range of the Pygmy Skipper in Bulgaria is most probably limited to the lowermost Struma valley; it seems highly unlikely that the species may occur anywhere else in the country. In our opinion, the region with suitable climatic conditions and habitats for this highly xerothermophilous species is the Kresna-Kulata section of the Struma valley, with limits to the west and east set respectively by the lowest foothills of Mt. Ograzhden and Mt. Pirin (see Fig. 1). The total area of the thus defined potential range (extent of occurrence) of *G. pumilio* in Bulgaria is less than 500 km^2. Furthermore, beside being very limited in absolute terms, this potential range of the species in Bulgaria is situated in a rather densely populated region with developed and locally intensifying human activities such as agriculture, road construction, and gravel extraction from riverbeds. Hence the actual area of occupancy must be much smaller – probably not more that 10% of the entire potential range.

This anthropogenic activity is exceedingly likely to be detrimental to *G. pumilio*. Especially worrying are the effects of the just completed construction of the Struma Highway, which has caused both a spike in gravel extraction from local rivers such as Struma and its tributary Melnishka reka, as well as the literal and dramatic annihilation of large sections of potential habitat, e.g. the south-facing hillsides north-west of Marino Pole village (Z. Kolev, pers. obs.). Activities such as these will very likely lead to the degradation and destruction of the habitats of *G. pumilio*, *G. nostrodamus*, and possibly other xerothermophilous species which within Bulgaria are restricted to this region. However, the adverse impact could be particularly strong especially on the Pygmy Skipper, which appears to have an especially narrow ecological tolerance (Hesselbarth *et al*. 1995). Moreover, in case of the presently reported record the species is already at the vulnerable northernmost extremity of its range, which makes it succeptible to greatly increased risk of stochastic extinction due to natural causes alone. It is to be noted that the existence so far of only a single Bulgarian record of *G. pumilio* indicates that this species is much rarer than *G. nostrodamus* in the country. This is especially true in light of the fact that the lower Struma valley is very well studied by national standards, since it has been a collecting hotspot for Bulgarian and foreign lepidopterists for over a century.

The above analysis indicates that *G. pumilio* satisfies IUCN criteria B1+2ab(iii) for Endangered regional Red List status in Bulgaria (IUCN 2012a). Since the Pygmy Skipper usually occurs in widely separated small colonies (Larsen 1982, Hesselbarth *et al.* 1995), the possibility that an endangered population may be rescued by cross-border migrantion does not seem significant and is unlikely to affect the extinction risk; hence no adjustment of the category is deemed necessary (IUCN 2012b). Considering the significant anthropogenic pressures on the distribution area of this species, *G. pumilio* should be considered a species of high conservation priority. We also recommend its inclusion into the Red Data Book of Bulgaria. Because of the very limited data on its actual distribution and population trends, urgent research must be undertaken in order to gather more information and to determine appropriate conservation measures. As our preliminary assessment of the extinction risk is based mainly on the availability of suitable habitats, additional data may result in raising the threat category to Critically Endangered.

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Over de gele oranjetipjes, *Anthocharis cardamines* ab. *aureoflavescens* Cockerell (Lepidoptera: Pieridae) in mijn vlindercollectie

Melkert F.

Samenvatting. De auteur beschrijft de vondst en de kweek van *Anthocharis cardamines* ab. *aureoflavescens* Cockerell in Noord-Holland, Nederland, van 1971 tot 1977.

Abstract. The author describes the discovery and the breeding of *Anthocharis cardamines* ab. *aureoflavescens* Cockerell in the province of Noord-Holland, The Netherlands, from 1971 till 1977.

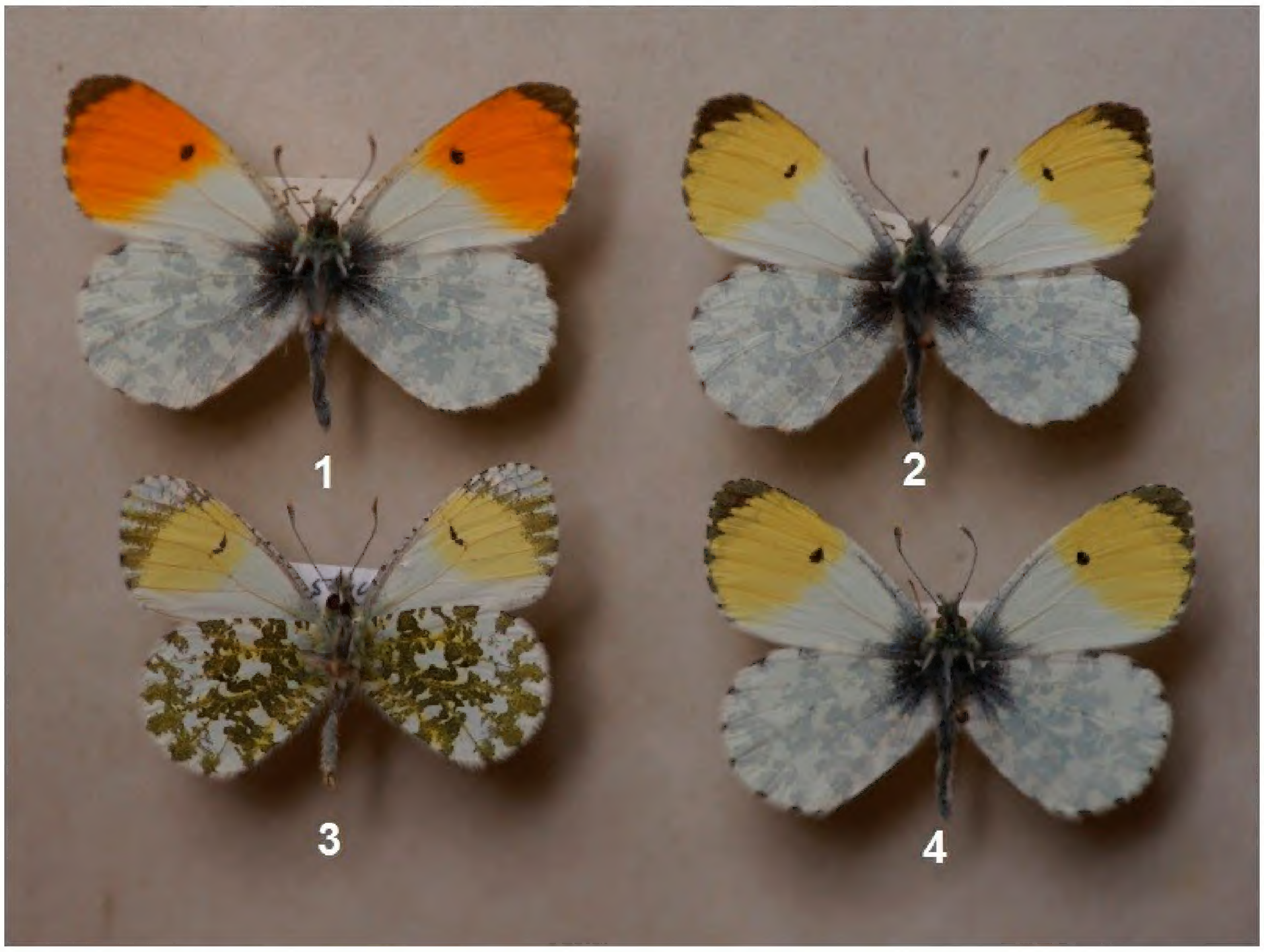
Résumé. L'auteur décrit la découverte et l'élevage d'*Anthocharis cardamines* ab. *aureoflavescens* Cockerell dans la province de Noord-Holland, Pays-Bas, de 1971 à 1977.

Key words: *Anthocharis cardamines* ab. *aureoflavescens* Cockerell – aberration – The Netherlands – Lepidoptera.

Melkert F.: Sint-Adelbertabdij, Abdijlaan 26, 1935 BH Egmond-Binnen, Nederland.

In het artikel van Stef Spruytte en Sylvain Cuvelier (2015) las ik met belangstelling over een vrouwtje van *Anthocharis cardamines* (Linnaeus, 1758) met een zeldzaam afwijkend vlekkenpatroon, nl. de forma *decolorata* (Caruel, 1955). Het is wel zo dat bij de witjes of Pieridae hoogstzelden aberraties worden waargenomen. Toch had ik het geluk om zelf kennis te mogen maken met een aberratie van *Anthocharis cardamines* die nog niet eerder in Nederland was gemeld, nl. de forma *aureoflavescens* Cockerell.

In het voorjaar van 1971 kweekte ik uit eitjes van een gevangen vrouwtje een vijftiental rupsen op, die alle goed verpopten. De rupsen werden elk apart opgekweekt om kannibalisme te voorkomen. Het gevangen vrouwtje vloog al eierleggend langs de Zeeweg bij Castricum (Noord-Holland), ter hoogte van het bezoekerscentrum "De Hoep". Half april 1972 slopen al enkele mannetjes uit de pop met normale oranje voorvleugels (Fig. 1), maar op 25 april ontpopte een mannetje waarvan de voorvleugels botergeel waren (Fig. 2). Diezelfde dag kwam nog een ander mannetje uit de pop met oranje voorvleugels maar langs de binnenrand met een zweempje geel. Op 27 april kwam er weer een botergeel mannetje (Fig. 4) uit de pop en tevens enkele vrouwtjes die normaal van kleur waren.



Figs. 1–4. *Anthocharis cardamines* (Linnaeus, 1758). Mannetjes. Vindplaats: Castricum (Noord-Holland), leg. en coll. F. Melkert.

Fig. 1.– nominaatvorm, 25.iv.1972, ab ovo.

Fig. 2.– forma *aureoflavescens* Cockerell, 25.iv.1972, ab ovo.

Fig. 3.– forma *aureoflavescens*, onderzijde, 17.v.1977.

Fig. 4.– forma *aureoflavescens*, 27.iv.1972, ab ovo.

Foto: Jack Pouw.

Over gele oranjetipjes kon ik in de literatuur niets vinden. Dus schreef ik toentertijd naar vlinderkenner B. J. Lempke in Amsterdam om te vragen of hij dat verschijnsel kende. Op 4 juni 1972 antwoordde Lempke mij het volgende: "U hebt wel een zeldzaam geluk gehad met de kweek van *A. cardamines*. De vorm met gele in plaats van oranje vlek is bekend maar zeer zeldzaam. De juiste naam is ab. *aureoflavescens* Cockerell. Voor zover ik weet is dit de eerste keer dat hij in Nederland is waargenomen. Zonder twijfel een erfelijke vorm, in het

buitenland op diverse plaatsen waargenomen, maar steeds zeer zeldzaam.”.

De twee gele exemplaren kwamen in mijn vlindercollectie terecht. De vrouwelijke exemplaren liet ik weer vrij in de buurt waar ik oorspronkelijk de stammoeder had gevonden. Aan deze vrouwtjes was immers niet te zien of ze gele of oranje nakomelingen zouden voortbrengen. Vijf jaar later was ik in elk geval erg verrast toen ik op 17 mei 1977 in de natuur een geel oranjetipje zag vliegen (fig. 3), juist weer in de omgeving waar ik indertijd de bewuste stammoeder had gevangen. Ik vermoed dat het een nakomeling betrof van de uitgezette vrouwtjes maar daarvan valt natuurlijk niets te bewijzen. Ook dit exemplaar kwam in mijn collectie terecht maar deze keer geprepareerd met de onderkant naar boven.

Zou het niet de moeite lonen om in het voorjaar eens goed op gelige witjes te letten die dan mogelijk gele mutanten van het oranjetipje kunnen zijn en onder de vele witjes niet gemakkelijk opvallen. Of is die mutant werkelijk zo zeldzaam? Ten slotte een kleine bedenking: is het geel oranjetipje een primitieve vorm of zou de oranje kleur in de verre toekomst juist meer naar geel gaan neigen ? Een vrijwel onoplosbare vraag, lijkt me. Echter wel uitermate boeiend.

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Spruytte S. & Cuvelier S. 2015. Recente dagvlinderobservaties in West-Vlaanderen (Lepidoptera: Papilionoidea). — *Phegea* **43**(1): 22–24.

Boekbespreking

Bakker W., Bouwman J., Brekelmans F., Colijn E., Felix R., Grutters M. Kerkhof W. & Kleukers R. 2015: *De Nederlandse sprinkhanen en krekels* (*Orthoptera*).

17 × 24 cm, 248 p., 628 figuren waarvan de meeste in kleur, te bestellen bij eis@naturalis.nl of online via www.eis-nederland.nl/et, paperback 17,50 € (ISSN 1875-760x).

Dit achtste deel in de reeks *Entomologische tabellen* is tevens het dikste en het rijkst geïllustreerde, hoewel er van deze orde slechts 50 soorten in Nederland voorkomen van de iets meer dan 26.000 beschreven soorten wereldwijd.

Na enkele inleidende hoofdstukken met o.a. info over het atlasproject, de biologie van sprinkhanen en krekels, hun morfologie, systematiek, verspreiding in Nederland, volgt een rijkelijk geïllustreerde determineertabel tot op soortniveau. Daarna volgen de besprekingen van de individuele soorten, met vermelding van de Nederlandse en Latijnse naam, een korte beschrijving van het uiterlijk (lengte van mannetje en vrouwtje, algemeen uiterlijk, verschillen met gelijkende soorten), biotopen, het voortgebrachte geluid, de levenscyclus, het voorkomen in Nederland (met info over de bedreigingstoestand), en tips met de meest geschikte methodes om de soort te kunnen waarnemen.

Van elke soort worden zowel het mannetje als het vrouwtje met een fraaie kleurenfoto afgebeeld. Bij elke soort hoort verder een stippenkaart met de verspreiding in Nederland en een geluidsdiagram van de roepzang van het mannetje. De kaarten geven met een grijs blokje het voorkomen aan vóór 1990 en met een rode stip de latere waarnemingen. Achteraan worden de kaarten vergeleken met de meer nauwkeurige waarnemingen van het atlasproject 2006–2014.

Veel van de informatie in deze publicatie is afkomstig van het tweede atlasproject. Nadat het eerste project, van 1990 tot 1995, met enkele honderden medewerkers uitmondde in de publicatie *De sprinkhanen en krekels van Nederland* (*Orthoptera*), veranderde de fauna beduidend en daarom werd besloten een tweede project te starten waaraan niet minder dan ruim 3700 medewerkers deelnamen. Dit project liep van 2006 (start van waarneming.nl!) tot 2014 en de gegevens werden verwerkt tot deze *Entomologische Tabel* **8**.

Achteraan bevindt zich een overzicht van alle geluidsdiagrammen, een literatuurlijst, enkele trendgegevens i.v.m. het voorkomen van de verschillende soorten, een lijst van alle waarnemers met minstens 5 waarnemingen en een alfabetische index.

De tabel is zeer keurig uitgegeven en bevat een schat aan gegevens. Zij kan zonder meer met groot succes gebruikt worden als determineertabel voor de Belgische soorten. Een aanrader!

Willy De Prins